Fall 2014

Analyzing The Importance Of Diversifying Beyond Tobacco For Small-Scale Farmers In Malawi

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Graduate School Form 30
(Updated 11/20/2014)

PURDUE UNIVERSITY
GRADUATE SCHOOL
Thesis/Dissertation Acceptance

This is to certify that the thesis/dissertation prepared

By Mphatso C. Mbulukwa

Entitled ANALYZING THE IMPORTANCE OF DIVERSIFYING BEYOND TOBACCO FOR SMALL-SCALE FARMERS IN MALAWI.

For the degree of Master of Science

Is approved by the final examining committee:

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Approved by: Gerald E. Shively 12/09/2014

Head of the Department Graduate Program Date

ANALYZING THE IMPORTANCE OF DIVERSIFYING BEYOND TOBACCO FOR SMALL-SCALE FARMERS IN MALAWI

A Thesis

Submitted to the Faculty

of

Purdue University

by

Mphatso C. Mbulukwa

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Science

December 2014

Purdue University

West Lafayette, Indiana

To Anthony and Lusayo my two favorite men, you are my inspiration

ACKNOWLEDGEMENTS

I extend my exceptional and wholehearted gratitude to my major supervisor Professor Gerald E. Shively and my co-supervisors Dr. Ricker Gilbert and Professor. Joan Fulton for their technical guidance, motivation, understanding, and patience provided to me during the entire process of this thesis work. My sincere thanks go to Carole Braund and Lou Ann Baugh for all their support during the entire period of my study

I would like to express my special appreciation to United States Agency for International Development (USAID) for sponsoring my study and research work. This financial support has helped me to realize my dream

To my loving husband and friend Anthony, thanks for always being there for me and for motivating me to press hard when I did not have the energy. To my Parents, Mr. and Mrs. Mbulukwa, I owe everything to you, may God continue to blessing you. To my friends Francis, Akuffor, Audrianne and Phillip, I appreciate your love and support.

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ABSTRACT

Mbulukwa, Mphatso C. M.S Purdue University, December 2014. Analyzing the Importance of Diversifying Beyond Tobacco for Small-Scale Farmers in Malawi. Major Professor: Gerald E. Shively.

This thesis analyses potential agricultural alternatives to production and marketing of tobacco in Malawi. I study existing patterns of crop and income diversification and factors that limit crop diversification. I also provide an analysis of the current profitability of different important cash crop alternatives that are commonly grown among smallholder farmers and compare their profitability to that of tobacco.

Following a review and synthesis of available literature on alternatives to tobacco, analysis is presented that relies upon data collected in 2009 from 380 households in Kasungu and Machinga districts of Malawi. Simpsons Index of diversification was used to measure the extent of diversification for both crop and income sources. Gross margin analysis was employed to identify alternative commodities to tobacco while OLS and Tobit regression models were used to analyze the determinants of crop diversification.

The OLS results indicated that crop diversification is determined by age and level of education of the household head, number of children under 12 years old, household size, land holding size, access to input loan, distance to market and ownership of livestock units. Age of household head, distance to market and number of children

less than 12 years old showed a negative relationship with crop diversification while educational level, household size, land holding size, livestock ownership and access to loan were found to favor crop diversification. The Tobit results indicated that crop diversification is positively influenced by educational level of household head, household size, land holding size, access to input loan and ownership of livestock units. However both models indicate that there are significant differences in crop diversification levels between the two districts, with Kasungu having higher diversification levels than Machinga district.

The study has shown that there is non-specialization among the farm households from the two study areas in terms of number of crops grown and number of income sources. The Simpsons indexes for both crop and income diversity was 0.56 and 0.84 respectively. The results also indicate that these farm households grow 4 crops on average and have an average of 4 income sources per farmer. However the study further reveals that majority of these households prioritize home consumption need when they produce these crops as a result majority of them do not sell their produce.

Gross margin analysis indicated that tobacco continues to have high comparative advantage over other crops just because it had a higher gross margin than all other crops. The profitability of maize was higher than grain legumes and root crops. Horticulture crops (tomato, leafy vegetables and Irish potato), Soybean, dry beans and groundnuts were found to be possible alternatives to tobacco as they have high gross margins than other crops and have an added advantages over tobacco in that they can be grown 3 to 4 times per year.

CHAPTER 1: INTRODUCTION

Malawi

Malawi is a landlocked country in South East Africa. It has a total area of 118,480 km^2 of which 20 percent is covered by water. Malawi shares borders with three countries namely Tanzania, Mozambique and Zambia. The country has an estimated total population of 16.36 million people (NSO, 2013). About 20 percent of its total area is covered by water.

Malawian Agriculture Sector

Agriculture is the back bone of Malawi's economy. It contributes to almost 42% of GDP and 80% of export earnings. Malawi's agriculture sector can be categorized into smallholder and estate sectors. The small-scale farmers grow crops mainly for subsistence but also they do grow crops such as tobacco, coffee and ground nuts for cash. Maize, which is the country's staple food, accounts for nearly 90 percent of the total cultivated land. Other crops grown for food are rice, sorghum, root crops, millet, pulses, vegetables and fruits. The major cash crops include cotton, rice, groundnuts, coffee, and tobacco.

Recent concerns about the health risk of smoking have promoted global efforts to reduce smoking which would potentially result in reduced demand for tobacco. A reduction in demand for tobacco would weaken Malawi's economy and induce unemployment. It is with the aim of mitigating the effects of reduced tobacco production that the government is encouraging farmers to grow other high-value crops in addition to maize and tobacco.

Importance of Tobacco to Malawi's Economy

Tobacco is an important component of the Malawian economy because it is a major cash crop. It provides both income and employment opportunities to Malawians. Tobacco contributes about 70 percent of total exports. Tobacco is the second mostly widely grown crop after maize and the country exports more than 95 percent of the tobacco it produces. The two most commonly grown tobacco varieties are burley and flue cured. Smallholders tend to grow burley tobacco because flue-cured production has high capital and labor needs. In terms of gender, burley tobacco production is dominated by males. According to the Malawi Government and the World Bank (2006), 19 percent of male-headed households grow tobacco as compared to only 7 percent of female-headed households.

Approximately 2 million Malawians are employed in the tobacco industry as laborers and tenants. 122,000 hectares of land out of 4.6 million hectares are under tobacco production. In 2014, a total of approximately 160,000 tons and 31,000 tons of

burley and flue cured tobacco were produced. This is in comparison to a total of 145,000 tons of burley and 20,000 tons of flue-cured tobacco produced in 2013. Smallholder farmers contributed a total of 170,000 tons of the total quantity sold. The total sales of all types of tobacco in 2013 were MK147 billion, of which MK129 billion (88%) was received by smallholder farmers. A trend of declining tobacco prices is indicated in Table 1. The observed increase in revenue (in Kwacha terms) reflects the depreciation of the Malawi Kwacha against the United States Dollar.

Table 1: Comparison of Tobacco Sales between 2013 and 2014

Type of Tobacco	2013			2014		
	Quantity (tons)	Price per kg (MK)	Total Revenue (‘000,000MK)	Quantity (tons)	Price per kg (MK)	Total Revenue (‘000,000MK)
Burley	144,709	706.23	102,198	159,386	807.12	112563
Flue Cured	19,735	1085.385	21,420	31,063	1240.44	33716
NDDF	4,117	722.96	2,976	1,516	826.24	1096

Source: Tobacco Association of Malawi Website, 2014

Note: in 2013 US$1 = 380MK in 2014 US$1 = MK450

Some prior research on crop diversification has been conducted in Malawi. This study was conducted with the intention of contributing to the government's effort in promoting diversification. A review of the previous studies on diversification have all reached a similar conclusion, namely that Malawi should diversify out of tobacco and concentrate on high value, but less bulky crops such as spices, oil seeds, some horticultural crops, cotton, pulses and mushrooms (Mataya and Tsonga, 2001). Despite the continued importance of tobacco to Malawian farmers and the country as a whole, the value of the crop in terms of price per kg and quantities produced has declined.

Crop Diversification in Malawi

According to Jansen and Hayes, 1994; Agricultural diversification is defined as the altering of the structure and conduct of the agricultural sector in order to obtain some desired effect on its performance, for example raising productivity and reducing poverty Diversification is a means by which farmers can avoid income loss due to fluctuations in domestic and world prices and mitigate the effects of adverse weather conditions e.g. drought, floods and pest and disease outbreaks.

Crop diversification refers to the growing of many crops at the same time. It is often related to the switch from subsistence food production to commercial agriculture. Malawi has promoted crop diversification for more than 30 years. However despite all this effort, there is still low adoption of crop diversification by smallholder farmers. Some of the problems that have been contributed to this low adoption are lack of

knowledge by farmers on how to compare profitability of competing crops, poor dissemination of technical and economic information on potential commodities and lack of policy guidelines and strategy on how to implement crop diversification. Therefore stakeholders in Malawi, including policy makers, planners and donors are faced with a challenge to develop a criteria upon which agricultural diversification should be based.

Table 2 indicates statistics in terms of percentages on how different crops that are available in Malawi are cultivated by farmers from the two regions under study.

Table 2: Percentage of Farm Households Cultivating Different Crops in Malawi

Crop grown	Central region	Southern Region	National
Maize	97	99	97
Other cereals	14	33	24
Sweet potato	35	32	36
Cassava	11	24	21
Pulses	70	69	68
Groundnuts	53	25	38
Beans	34	13	23
Pigeon peas	3	54	27
Tobacco	25	6	15
Vegetables	40	33	36

Source: Malawi Government and World Bank (2006)

Study Objective

The main objective of this study was to analyze the potential alternative crops to tobacco in Malawi. The specific objectives were to study existing patterns of crop and income diversification, to assess the profitability of different important cash crops and compare their profitability with tobacco and to identify determinants of crop diversification. This was done through the use of Simpsons Index of Diversification, Gross Margin Analysis, and regression analysis using Ordinary Least Squares (OLS) and Tobit models. The results of the study were then aimed at proposing future policy, strategies for implementation and to highlight areas for future research.

Literature on Crop Diversification

Numerous studies have been conducted on the determinants of crop diversification. A study by Mataya and Tsonga 2001, reported that despite various initiatives that have been made by the state on diversification of both food and cash crops, tobacco continues to be the country's major source of export earnings despite the declining revenues. Another study on crop diversification carried out in Pakistan by Ashfaq et al. (2008) found that crop diversification levels were determined by the size of landholding, the age, education level, farming experience, and off-farm income of the farmer, the distance of the farm from the main road and from the main market, and farm machinery ownership. In their study an entropy index was used to measure diversification

and, thereafter, a multiple regression model was used to identify the factors correlated with crop diversification.

Farm households' decision making on crop choice and cropland allocations can be influenced not only by farm household characteristics but also government policies such as fertilizer subsidy program (Di Falco and Perlings, 2005; Westcott and Young, 2004; Wu and Brosen, 1995) In turn, crop choice and cropland allocation decisions determine agricultural production levels. These decisions also affect land resource conditions, crop diversification, farm income level and household food security. These decisions have therefore become current issues of concern for both farmers and policy makers (Wu et al., 2008; Malawi Government and World Bank, 2006; Hua and Hite, 2005). Mataya and Chilima, (1998) reported that resource poor farmers are unlikely to venture into production of high value industrial commodities like cotton, paprika and sunflower especially when there is no potential viable market. In principle farmers choice of cash crop is determined by the relative profitability of competing enterprises within a given time period. However, in Malawi, farmers tend to prioritize food consumption over income generation as such they allocate resources into crops grown for consumption. Policies and strategies on resource use are influenced by efficiency, equity and sustainability concerns. Therefore agricultural support programs in form of fertilizer subsidies help to relax some of these constraints while offering economic and financial incentives that also influence farmers' crop choices and land allocation (Chembezi and Womack, 1992).

Other studies have shown that the major driving forces behind farmers' decisions on crop choices include farm household and land characteristics (Bergeron and Pender, 1999), crop varietal characteristics, (Smale et al., 1998), production (Kurukulasuriya and Mendelson, 2008), price risks (Collender and Zilberman, 1985), government policies, presence of technical programs and financial incentives (Chembezi and Womack, 1992).

Thesis Organization

This thesis consists of five chapters. Chapter 1 provides an introduction to the study and its objectives. Chapters 2 present the study methodology. This chapter describes the study area and sample households. Chapter 3 presents and discusses results obtained after analyzing the data. First I present descriptive statistics for the sampled households. This is then followed by a presentation of results of the Simpsons Index of diversity and gross margin analysis. Chapter 3 concludes with the presentation of results on the determinants of diversification. These were analyzed using OLS and Tobit regression models. Chapter 4 presents two case studies outlining the profiles of two farmers interviewed in Kasungu district as key informants. Chapter 5 summarizes the results and highlights areas for further research. The survey instruments used for the focus group discussions and the key informant interviews are provided in Appendices.

CHAPTER 2: STUDY METHODOLOGY

Data

This study used data that were collected through a household survey conducted in Kasungu and Machinga districts of Malawi in 2009. A total of 380 households were interviewed using a structured questionnaire. Out of the 380 households, 211 were from Kasungu and 169 were from Machinga. According to a report by Chibwana, 2010; this survey was conducted with the aim of collecting data that would support a study to analyze the effect of farm input subsidy program (FISP) on household resource allocation choices, and subsequent effects on forest resources. The sample and study site are described in greater detail in Chibwana's report. Data were collected on household characteristics, crop production, input use, incomes and expenditures and household s' participation in farm input subsidy program.

In addition to the survey data, the study also used secondary data and data that was collected through focus group discussions and key informant interviews that were conducted in Kasungu district in December 2013. In total, 5 focus group discussions and 5 key informant interviews were conducted using Participatory Rural Appraisal tools (PRAs). The purpose of conducting the focus group discussions was to have a general overview of crop diversification among smallholder farmers and also to investigate the

current trends of diversification amongst the smallholder farmers. During the focus group discussions, it was strategically planned to include all farmer categories in terms of gender and age differences.

The key informants in the study were farmers who were strategically targeted because they themselves have successfully diversified their crop production. The Village Headmen (Chiefs) played a key role in identifying the key informants in their villages. The main purpose of the key informants was to discover the characteristics and strategies of these farmers, whom might serve as role models to other farmers who are considering and pursuing diversification.

Study Areas

Table 3 provides a summary of the demographic and socioeconomic characteristics of the study area. Malawi is divided into three regions, namely North, Central and South. Kasungu district is located in the Central region of the country while Machinga district is located in the Southern region of the country. The main occupation of people from the study areas is agriculture. The Central Region is the most populous of the three regions and is regarded as the country's main food basket. Maize is the main staple food for people from both districts while tobacco is the main cash crop for people in Kasungu district.

Table 3: Socio-Economic and Demographic Profiles of the Study Area

Characteristic	Kasungu	Machinga
Area (Km^2)	7900	4990
Total population	616,085	488,996
Population density	78 people/km^2	98 people/km^2
Average land holding size	2.1 ha	1.0 ha
Average household size	4.8	4.5
Average annual rainfall	1031	915
Average annual household income (MK)	211,249	110,807

Specification of the Econometric Model

Empirical analysis in this study investigates key relationships between crop and income diversification with other key factors that are expected to influence crop diversification. I employ the Simpsons Index of Diversification (SID) in order to measure the extent of diversification for both crops and income sources.

The Simpsons Index of Diversity (SID) is computed for each household. It is computed as:

$$SID = 1 - \sum \left(\frac{n_i}{N}\right)^2$$

where: $\frac{n_i}{N}$ is the proportion of crops or the proportion of income derived from crop or source

The SID ranges between 0 and 1. If there is just one crop or one source of income, the $\frac{n_i}{N}$= 1 and SID = 0. As the number of crops/income sources increases, the share decreases, so that SID gets closer to 1. The closer SID is to zero, the greater the amount of specialization; the further it is from zero, the more diversification is present. The calculated index is then used as a dependent variable in order to examine relationships between some key factors and crop/income sources diversification. These factors are access to subsidized fertilizer, the gender of the household head, and access to off-farm employment.

Descriptive statistics such as percentiles, means, standard deviations and frequencies were also used in order to describe the demographic characteristics of the households and to help identify the significant differentiating socio-economic characteristics between different categories of farm households (for example male-headed households versus female-headed households). The statistical significance of the descriptive variables was tested using t-tests.

Multiple regression was also used to identify factors correlated with crop diversification. These models were used to assess the significance and potential importance of these factors in influencing farmers' decisions to diversify. The regression models were specified as:

$$Y_i = \beta_i x_i + \varepsilon$$

where:

Y_i = Actual number of crops grown (for OLS) or SID (for Tobit)

β_i = Regression coefficients

x_i = Explanatory variables

ε = Error term

Explanatory variables were defined as follows:

x_1 = Age of household head (dummy: 20 - 60 years = 1, > 60 and < 20 years = 0)

x_2 = Landholding size (dummy: < 1 ha = 0, > 1 ha = 1)

x_3 = Years of education household head (8 years and below = 0, >8 years = 1)

x_4 = Gender of the household head (dummy: male = 1, female = 0)

x_5 = Number of children under 12 years (dummy: < 5 children = 0, > 5 children = 1)

x_6 = Household size (dummy: < 5 members = 0, > 5 members = 1)

x_7 = Access to fertilizer subsidy (dummy: yes = 1, no = 0)

x_8 = Access to input loan (dummy: yes = 1, no = 0)

x_9 = Experienced natural disaster previous year (dummy: yes = 1, no = 0)

x_{10} = Access to off-farm employment or business (dummy: yes = 1, no = 0)

x_{11} = Availability of electricity in the village (dummy: yes = 1, no = 0)

x_{12} = Distance to a nearest market (dummy: < 30 Minutes = 0, > 30 minutes = 1)

x_{13} = District (dummy: Kasungu = 1, Machinga = 0)

All the variables used in the OLS model were also considered for the Tobit model. I used a two-tailed Tobit regression, with an upper limit of 1 and a lower limit of

0. I decided to employ the Tobit model in addition to the OLS model because Tobit model is one example of censored regression models that arise when the dependent variable is censored from below or above. The SID is censored because its values ranges between 0 for zero diversification and 1 for perfect diversification

Gross margins were also computed in order to assess the profitability of other important cash crops and compare their profitability with that of tobacco. Profit (π) is assumed to be a function of total revenue minus total cost. Total revenue is a function of crop yield and price while total cost is calculated as the sum of the costs of purchased inputs, the cost of transportation, the cost of land, the cost of processing and the cost of labor (both family and hired labor):

$$\pi = P.Q - \sum_{k} r_k.x_k$$

where: π = Profits, $P.Q$ = Total Revenue, $\sum r_k.x_k$ = Total cost, r_k = unit costs of inputs, and x_k = input quantities.

These gross margin analyses per hectare were conducted on 12 mostly common crops that were identified in the sample. These crops were maize, tobacco, cassava, ground nuts, soybeans, tomato, rice, vegetables, pigeon peas, dry beans, cotton and sweet potato. These crops were further studied during the focus group discussions conducted in order to identify total cost of production. The total cost of production included the following:

-Cost of labor (both hired and family labor)

-Input cost = cost of seed + cost of fertilizer + cost of chemicals

-Cost of processing

-Cost of land (rental value per hectare of land)

-Cost of transportation

Cost of hired labor was calculated by multiplying the number of hired person days per activity by the current wage rate for each activity. Family labour was calculated by multiplying the number of family labour person days per activity by the opportunity cost of family labour.

Description of Variables Used in the Study

Table 4 presents the definitions and measurements of the variables used in the study analysis. The explanatory variables consist of the socioeconomic and demographic factors (age, educational level and gender of the household head), farm-level factors specifically farm sizes and policy-level factors (access to fertilizer subsidy program and access to input loans). The variable for district (a dummy) was included in order to capture district differences in infrastructure development, facilities and services availability.

Table 4: Description of Variables Used in the Study

Variable name	Type	Description
Dependent variables		
SID_{crops}	Continuous	Crop diversification index
SID_{income}	Continuous	Simpsons Index of diversity for income sources
Crops	Continuous	Actual number of crops grown
Income sources	Continuous	Actual number of income sources in the household
Explanatory variables		
Age	Binary	Age of household head (dummy: 20 - 60 years = 1)
Gender	Binary	Sex of household head (1 = male)
Educational level	Binary	Years of education for household head (>8 years = 1)
Household size	Binary	Number of people in household (> 5 members = 1)
Children < 12 years	Binary	Total number of children under 12 years (> 5 children = 1)
Land holding size	Binary	Total land owned by farmer (> 1 ha = 1)
Fertilizer coupon	Binary	Whether household received fertilizer subsidy (yes =1)
District	Binary	District (Kasungu =1 Machinga = 0)
Off-farm employment	Binary	Whether household has access to off-farm employment (yes =1)

Hypothesized Effect of Some Explanatory Variables on Crop Diversification and Diversification of Income Sources

Table 5 presents a summary of the expected correlations between some of the explanatory variables used in the analysis and crop and income diversification levels. The choice of the explanatory variables was based on a review of literature on the topic and available data from the survey and focus group discussions.

Gender of the Household Head

This variable was included because household heads can choose to diversify or not based on their choice and access to resources. However previous studies have shown that access to resources such as land is critical for women with no use rights over a parcel of land because women rarely own or have control over land and other assets (Shezongo 2005). Therefore we expect to find male-headed households to be more likely to diversify than female-headed households.

Age of Household Head

This is one of the factors that can affect production decisions on the farm. It is expected that age will have a negative correlation with diversification because prior studies have shown that elderly farmers look at farming as just a way of life, whereas young farmers may be more inclined to look at farming as a business opportunity (FAO

2012). However, we expect age to also have a negative association with income diversification because as age increases, farmers tend to retire from other income-generating activities

Household Size

The larger the household, the more likely it is that the household will be able to diversify its crop production. Households with a large number of working-age adults are more likely to have available labor and a range of skills, as well as the inclination to diversify, even if household members are specialized individually (Minot et at., 2006). Therefore the size of the household is expected to be positively correlated with both crop and income diversification.

Landholding Size

Weiss and Briglauer (2000) and Benin et al. (2004) reported that crop diversification is associated with larger farms therefore it is expected that the variable will have a positive correlation with crop diversification

Fertilizer coupon

Fertilizer is one of the most important inputs for the production of various crops in Malawi. However Malawian farmers face challenges accessing fertilizers due to high costs. Results from a study by Kumar and Chattopadhyay (2010) indicated that the quantity of fertilizer obtained by farmers is positively associated with crop

diversification. Therefore it expected that this variable will be positively correlated with crop diversification.

Access to Loans

Similar to fertilizer subsidy, access to loans is expected to have a positive association with diversification. This is because farmers with access to loans in the form of a physical input or cash are able to purchase fertilizer or seed needed for them to produce a particular crop.

Distance to the Market

This variable is expected to have a negative relationship with both crop and income diversification. This is because the nearer to the market the farmer is, the easier it becomes for him or her to diversify and to take produce to market. Omamo, 1998 reported that households with poor access to markets face higher transaction costs in buying from or selling to the national economy

Education Level of Household Head

This variable is expected to have a positive relationship with both income and crop diversification. This is because people believe that educated people can understand agricultural instructions easily and are better able to apply skills imparted to them, unlike the uneducated. On the other hand, educated people have a variety of skills and competence necessary for them to pursue other off-farm employment. Previous findings

by Ibrahim et al. (2009) indicated a positive relationship between education level and crop diversification.

Children under 12 years

This is expected to have a negative relationship with crop diversification but have a positive relationship with income diversification. This is because households with large number of children have reduced family labor (for the farm work) than households with large number of working age adults. On the other hand, with reduced family labor and increased household size, the working age adults are more likely to look for alternative source of income to support their families

Experienced Natural Disasters

Natural disasters in the form of drought, flooding, wildfire, pest and diseases among others affect production levels of farmers. This variable is therefore expected to have a positive relationship with diversification because farmers will choose to grow more crops in order to mitigate the effects of these natural disasters.

Off-farm Employment

This is expected to discourage crop diversification but be positively correlated with income diversification.

Availability of Electricity

Households with electricity are more likely to participate in income generating activities. Thus, it is expected that households who has access to electricity may have more diverse income sources and participate less in on-farm activities. Therefore this variable is expected to have a negative correlation with crop diversification and a positive correlation with income diversification.

Table 5: Hypothesized Effect of Explanatory Variables on Crop and Income Diversification

Variable name	Relationship to crop diversification	Relationship to income diversification
Age	-	-
Gender (male =1)	+	
Educational level	+	+
Household size	+	+
Children under 12 years	-	+
Land holding size	+	+
Fertilizer coupon	+	+
District	+/-	
Off-farm employment	-	+
Natural disaster	+	+
Loan	+	+
Distance	-	-

CHAPTER 3: RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

In this section, I present the descriptive analyses of the study sample. This analysis provides a general picture of the relationships between crop diversification levels and some household characteristics. This information also indicates how farm households in the sample differ according to gender and geographical location in terms of crop diversification levels and the choices of what crop to grow.

324 of the surveyed households (85.26%) were male headed while 56 were female headed households representing 14.74%. Of the 380 households, 343 grew other crops in addition to maize and tobacco while the remaining 37 households grew only maize and/or tobacco. The majority of households interviewed did not do education beyond a primary level. This may have implications on their decision-making and also for their ability to grasp the new information and knowledge that is necessary to implement a diversification strategy that involves the use of new farming techniques. The average age of household head in the sample was 47, with the oldest being 90 and the youngest 20.

When the data are disaggregated by district, some minor demographic differences appear. These demographic characteristics are presented in Table 6.

Table 6: Descriptive Statistics of the Sample

Variable	Kasungu	Machinga	Total
Male headed households	197	127	324
Grew tobacco in 2009	98	33	131
Sold tobacco in 2009	98	33	131
Grew other crops in 2009	196	147	343
Sold other crops in 2009	120	48	168
Sold maize	2	13	15
Land holding sizes	2.12	0.99	1.6
Household head age	48.93	43.19	47
Married head of house	183	118	301
Household size	6.9	5.7	6.4
Children <12 years	3.03	2.93	3
No of crops grown	3.97	3.39	3.7
No of income sources	4.1	3.68	3.94
Poorest	129	67	196
Food secure	54	50	104
Access to off-farm employment	112	154	266

As for crop production, 259 out of the 380 households did not grow tobacco in 2009, only 121 households planted tobacco. The most commonly grown crops apart from maize and tobacco were groundnuts, soybean, cassava, sweet potato, dry beans and pigeon peas. However by looking at farmers growing each crop by district, the study shows that pigeon peas and rice are not commonly grown in Kasungu as no farmer planted these crops in 2009. This is because Kasungu has fewer dambos (irrigable land) as compared to Machinga. On the other hand, soybean and dry beans are not commonly grown in Machinga as compared to Kasungu as only 4 farm households grew soybean in Machinga as compared to 122 farm households in Kasungu. The average number of crops grown by the study households was 4 with the maximum of 6 and the minimum of 1 respectively. Disaggregating according to gender, the study indicated that a majority of women grow 2 crops or fewer while men grow 3 crops or fewer. More details on this are contained in Table 7.

Table 7: Farmers Growing Other Crops per District

Crop	Kasungu	Machinga	Total
Cassava	47	72	119
Groundnuts	139	56	195
Soybean	122	4	126
Sweet potato	61	28	89
Irish potato	16	0	16
Dry beans	69	4	73
Cow pea	6	10	16
Sorghum	0	35	35
Millet	15	7	22
Tomato	10	9	19
Sunflower	13	0	13
Pigeon peas	0	61	61
Rice	0	30	30
Vegetables	3	2	5
Sugarcane	0	5	5
Oranges	0	3	3
Cotton	0	1	1

Source: survey data

Analysis of Relationships between Key Variables with Crop and Income Sources Diversification

This section provides a general picture of the relationships between crop diversification levels and some household characteristics. This information also indicates how farm households in the sample differ according to gender and geographical location in terms of crop diversification levels and the choices of what crop to grow.

The results of the two-sample t-test of some selected key variables presented in Table 8 indicate that for the crop diversification index, there are no statistically significant differences in the mean crop diversification levels between households that received maize seed coupon with those that did not. However the results indicate that there are statistically significant differences in the mean crop diversification levels between households that received any type of fertilizer coupon that is for either maize or tobacco with those that did not. The results also indicate that there are statistically significant differences in the mean crop diversification levels among households that have access to off-farm employment with those that did not have access. Farm households that accessed a maize seed coupon have a mean crop diversification level of 0.539 while those that did not access the maize seed coupon have a mean crop diversification level of 0.508, a difference that is both small and not statistically different from zero. Those farmers who received any type of fertilizer coupon have a mean crop diversification level of 0.576 while those that did not receive any fertilizer coupon have a mean crop diversification level of 0.442.

Table 8: Two Sample T-test of Equal Variance for Selected Variables

Variable	N	Mean	Std error	t-statistic	P-value
Crop diversification index					
Female-headed households	56	.514	.025	-1.988	.0237*
Male-headed households	324	.565	.010		
Crop diversification index					
Machinga	168	.505	.014	-5.185	0.0000***
Kasungu	212	.599	.012		
Crop diversification index					
Maize seed coupon	265	.539	.014	-1.007	0.12NS
Not received seed coupon	115	.508	.012		
Crop diversification index					
Received fertilizer coupon	326	.576	.009	-5.062	0.0000***
Not received fertilizer coupon	54	.442	.033		
Crop diversification index					
Access to off-farm employment	114	.510	.020	-3.304	0.0005***
No access	266	.577	.009		
SID for income sources					
Machinga	168	.812	.012	-3.506	0.0003***
Kasungu	209	.862	.009		
SID for income sources					
Female headed	56	.819	.017	-1.172	0.1209
Male headed	324	.843	.008		
SID for income sources					
Access to off-farm employment	114	.723	.013	-12.294	0.0000***
No access	266	.894	.007		

Comparing the two districts, the results show that Machinga has a statistically significant lower mean crop diversification level (0.505) than Kasungu (0.599). In terms of gender, I find that there is a statistically significant difference between female headed households and male- headed households. Female headed households have significantly lower mean crop diversification level (0.514) than their male counterparts (0.565).

Households who do not have access to off-farm employment have higher mean crop index (0.58) than households who have access (0.51). This difference is significant and is as expected because farmers who do have access to off-farm employment divide their time and attention between the farm and the other job which restricts them from growing more crops. And also those farmers with off-farm employment may have income required to purchase other crops that they do not grow themselves

On diversity in income sources, the results show that there are no statistically significant differences in the mean number of income sources among households who received a fertilizer coupon with those who did not. On the other hand, the results showed that there are statistically significant differences between the mean number of income sources between the households according to district and type of household head in that male headed households have a slightly higher mean index (0.82) than the female households (0.84) and in the same way households from Machinga have a lower index (0.81) than farm households from Kasungu (0.86). Households who do not have access to off-farm employment have higher mean income diversity index (0.89) than households who have access (0.72). This difference is statistically significant.

Based on these t-test results alone, it is difficult to draw conclusions regarding the relationships between farm household's crop diversification levels for both crop production and income sources at this point with the factors discussed above. This is because there may be other factors both at farm and household levels that may also explain crop and income diversification. It is therefore after I look at the results from the regression analysis that I can make more confident conclusions and inferences about the relationships between these variables. These regression results are presented in the next section.

Crop and Income Diversification

While the main focus of the study is measuring crop diversity, I thought it useful to present some analyses on diversity of income sources. This is because of the assumption that some farmers could have other sources of income apart from agriculture which could explain the reason why they do not diversify their crop production. The simplest measure of diversity in income sources was the average number of income sources each of the study households had. Household income was divided into six major categories namely crop sales, livestock sales, sale of forest products, off-farm wage, business and other sources. The other sources category comprised of income received from sources like remittances and gifts among others.

When calculating the Simpsons Index of Diversification, 12 mostly common grown crops were selected among the crops studied during the survey. These crops are maize, tobacco, groundnuts, soybean, cassava, sweet potato, dry beans, pigeon peas,

sorghum and rice. However some crops were location specific. For example, sorghum, rice and pigeon peas were found to be grown in Machinga only, while dry beans and soybeans were found to be grown in Kasungu only. In total 19 other crops were grown by the households in addition to maize and tobacco but I concentrated my analysis on the 10 most popular ones.

Results from the calculation of the Simpsons Index of Diversity for both income sources and crop production are presented in Table 9.

Table 9: Measurement of Crop and Income Sources Diversity

Variable	Mean	Minimum	Maximum	SID
Crops	3.5	1	7	0.56
Income sources	3.9	1	6	0.84

Source: Survey data

The results indicate that the average number of crops grown was 4 and the SID value was 0.56. This result does not agree with the findings of Minot et al. (2006) that rural households grow up to five or six crops. The minimum number of crops grown was 1 while the maximum was 7. These results indicate non-specialization among the respondents. Smallholder farmers may practice crop diversification with the aim of meeting consumption needs, reducing risk associated with weather or disease outbreak or for economy of scale. However only 183 farm households sold at least one of the crops

they produced while a majority, i.e. 197 out of 380 households (52%) did not sell any crop. This means that a majority of farm households in these areas prioritize home consumption in their crop production. Results from the focus group discussion further reveals that most farmers do not allocate special land for these other crops but most of them are inter-planted with maize especially beans, pigeon peas and cow peas.

In terms of food security, 276 (73%) of the households reported being food insecure, while 104 (27%) reported being food secure. This then indicates that even though farmers grow more than one crop, they still do not meet their consumption requirements – mainly because they do not purchase the inputs required to produce more crops. However, low interest in these crops could partly be due to inadequate technical knowledge and higher cost of inputs especially fertilizer.

Regarding the diversity of income sources, the average number of income sources among the households was four and the SID value was 0.84. There were no major differences between districts. Both had the same average number of income sources (4.1 for Kasungu and 3.7 for Machinga), and similar SID values for income sources (0.87 for Kasungu and 0.82 for Machinga). 256 farmers had access to off-farm employment (149 in Kasungu and 107 in Machinga). The average number of income sources was 3.9 for male-headed households and 3.7 for female-headed households.

190 out of the 380 households (50%) had access to wage income and 155 out of 380 had access to business income. A majority of the households (367 out of 380) had access to forestry income, that is, they sold forest products such as firewood. This may reflect that the original study that produced the data deliberately targeted households

belonging to Forest User Groups (FUGS) near two of the country's forest reserves (Liwonde Forest Reserve in Machinga and Chimaliro Forest Reserve in Kasungu).

Household income was summarized in two categories: (1) household cash income, which was derived by summing sales of agricultural products, wage income, business income and other cash income sources; and (2) total household income, which included the imputed value of agricultural products produced and retained for household consumption. The computations were as follow:

Value Income = quantity produced *selling price

Cash income = Quantity sold * selling price

Therefore total agriculture income is calculated as follows:

Agriculture cash income = Livestock sales + Crop sales

Agriculture value income = (Number of livestock owned*selling price) + (Quantity of crops produced* selling price)

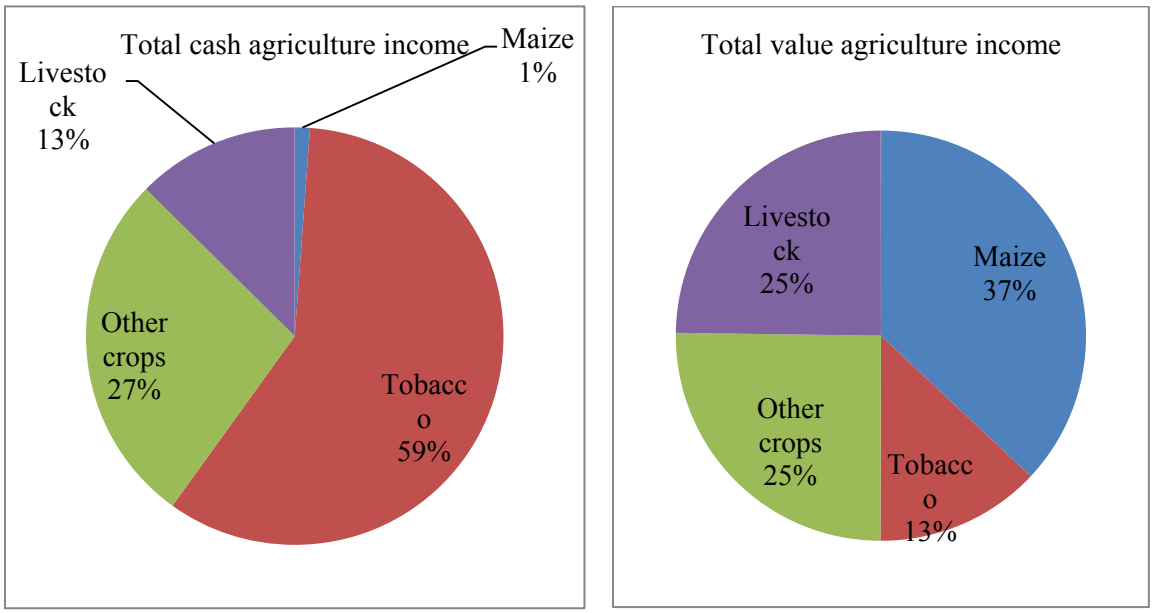

Figure 1: Percentage Total Cash Agriculture Income versus Total Value Agriculture Income

Figure 1 shows that in terms of cash income, tobacco contributed 59 percent to the agricultural income and maize contributed only 1 percent. Of total agricultural income, tobacco contributed the least (13 percent) and maize contributed the most (37 percent). This indicates that smallholder farmers put much regard to tobacco as a cash crop while the other crops are grown as food crops. This is further supported by the fact that all farmers who grew tobacco during the study period sold the crop while only a few households sold maize and other crops. Results from the focus group discussions further revealed that smallholder farmers grow other crops as a way of managing risk associated with poor maize harvest and they are not motivated to grow other crops with a business mind because they do not have ready markets and government does not prioritize

extension messages on production of such crops as they do with tobacco and maize. With livestock, the results are almost the same that most households do not commonly sell their livestock units as a result they realize very little cash income from their livestock. A further investigation during the focus group discussions revealed that most farm households keep livestock for prestige because people regard farmers with large livestock units as rich people. In addition these farmers only eat their livestock during ceremonies like weddings and funerals. And also the study revealed that majority of the households during the study period were keeping small stock livestock especially chickens and ducks which are sold at very low prices thereby contributing very little to the total agriculture income.

Average household cash income in the sample was MK 81,224 and average total income was MK105,854. Total cash income from agriculture was MK 23,824 on average, the total value of agricultural production was MK 103,445. This implies that a majority of the households do not sell their agricultural production (especially maize and other crops). They just produce it for home consumption not as source of income. Forestry contributed a large share of cash income to sample households while agriculture (crops and livestock) contributed the least (see figures 2 and 3 below). This clearly indicates that the majority of smallholder farmers in the sample grow food crops mainly for subsistence.

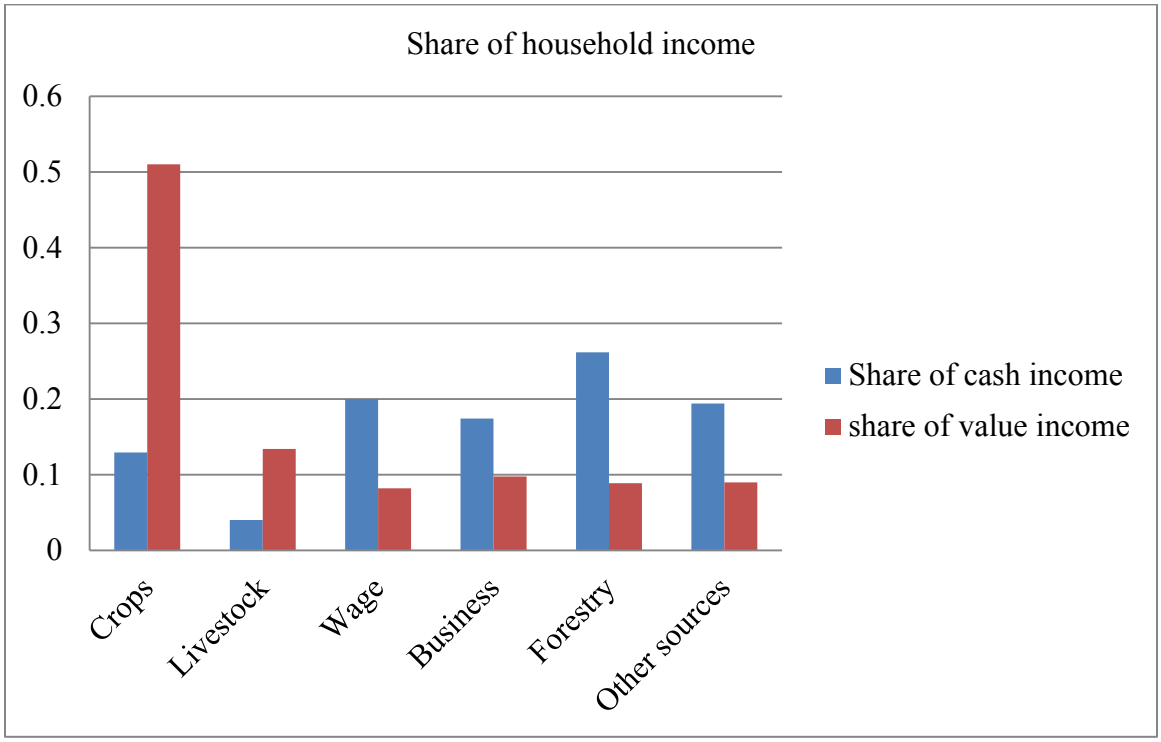

Figure 2: Share of Total Household Income among Sources

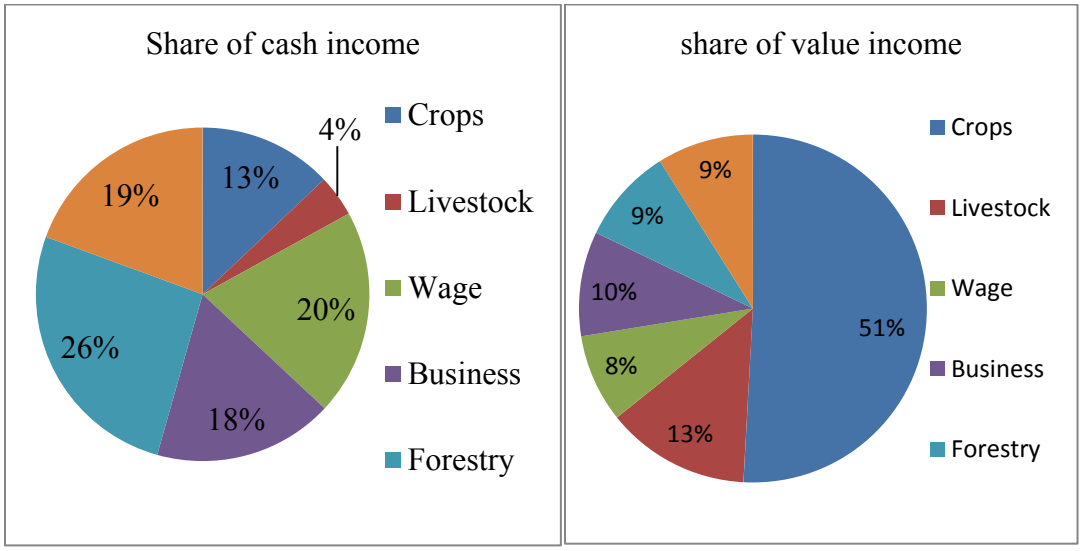

Figure 3: Percentage Share of Total Household Income across Sources

Determinants of Diversification

OLS regression results indicate that crop diversification is significantly and positively correlated with education, household size, landholding size, access to loan and livestock ownership. In contrast, negative associations were observed with age of household head, children less than 12 years and distance to market center. A significant difference in districts is also reflected in the positive coefficient for the district dummy variable. For the Tobit model, significant relationships were observed between crop diversification and educational level of house hold head, household size, land-holding size, access to input loan, ownership of livestock, access to fertilizer subsidy, availability of electricity, distance to market, access to off-farm employment, number of children less than 12 years and district dummy variables. Educational level of household head, household size, land-holding size, access to input loan, ownership of livestock and district dummy variables indicated positive correlations with crop diversification. On the other hand, distance to market, access to fertilizer subsidy, availability of electricity, access to off-farm employment and number of children less than 12 years indicated a negative correlation. Surprisingly age of household head had a positive relationship with crop diversification in the Tobit model but has a negative relationship in the OLS model. However a majority of the variables from the models had similar signs (see Table 12).

Table 10: OLS Regression Results, dependent variable is number of crops

Variable	Coefficient	Std error	T value	P-value
Age	-.006	.005	-1.223*	0.224
Male headed	.023	.242	0.10NS	0.924
Education	.041	.022	1.89**	0.085
Children < 12 years	-.161	.058	-2.79***	0.006
Household size	.134	.042	3.16***	0.002
Off-farm employment	-.195	.153	-1.28NS	0.202
Natural disaster	.202	.145	1.40NS	0.162
Subsidy fertilizer	-.948	.193	-4.91***	0.000
Land size	.162	.049	3.32**	0.001
Loan	.608	.286	2.13**	0.034
Own livestock	.646	.169	3.80***	0.000
Electricity	-.162	.178	-0.91NS	0.0.364
Distance to market	-.188	.064	-4.35***	0.000
District (1 = Kasungu)	.341	.153	2.23**	0.026
Constant term	2.064	.390	5.29	0.000

R^2 = .47 N = 380 F-Ratio = 4.43*** NS = Not significant

* = Significant at 10% level ** = Significant at 5% level *** = Significant at 1% level

Table 11: Tobit Regression Results, dependent variable is SID

Crop diversification Index	Coefficient	Std error	T-value	P-value
Age	.0241378	.0203275	1.19^{NS}	0.236
Male headed	.0006776	.0237463	0.03 ^{NS}	0.977
Education	.0531642	.0240566	2.21**	0.028
Children < 12 years	-.0631153	.0297387	-2.12**	0.034
Household size	.0373013	.017494	2.13**	0.034
Off-farm employment	-.0309619	.0185306	-1.67**	0.096
Natural disaster	.0173849	.0178593	0.97^{NS}	0.664
Subsidy fertilizer	-.1153029	.0241182	-4.78***	0.605
Land size	.067326	.0173607	3.88***	0.010
Loan	.0631961	.035421	1.78**	0.075
Own livestock	.0922334	.020632	4.47***	0.000
Electricity	-.025625	.0177562	-1.44*	0.150
Distance to market	-.0510057	.0183122	-2.79***	0.006
District (1 = Kasungu)	.0438446	.0193101	2.27**	0.024
Constant term	.325239	.0323647	10.05	0.000

N = 380 LR chi2(15) = 15.27** Prob > chi2 = 0.03832

Log likelihood = -422.5***

Table 12: Comparison of OLS and Tobit parameter estimates

Variable	OLS	Tobit	Expected
Age	-	+	-
Male headed	+	+	+
Education	+	+	+
Children < 12 years	-	-	-
Household size	+	+	+
Off-farm employment	-	-	-
Natural disaster	+	+	+
Subsidy fertilizer	-	-	-
Land size	+	+	+
Loan	+	+	+
Own livestock	+	+	-
Electricity	-	-	-
Distance to market	-	-	-
District (1 = Kasungu)	+	+	+/-

I now present a discussion on the variables that have significant relationships with crop diversification for both OLS and Tobit models.

Age of Household Head

Age of household head has a negative but significant relationship with crop diversification. This is as expected that the number of crops grown decreases with the age of the household head. This finding seems to indicate that young farmers try a variety of new crops at first but as they gain more experience with time, they tend to concentrate on only those crops that they prefer. This agrees with a study by FAO (2012) which reported that elderly farmers look at farming as just a way of life, whereas young farmers may be more inclined to look at farming as a business opportunity for family sustenance

Land Holding Size

As expected, land holding size has a positive and significant relationship with crop diversification. This indicates that number of crops grown by a household increases as the land holding size increases. One of the challenges Malawian farmers are facing is small landholding size. This means that with extra landholdings, farmers might be able to increase the number of crops grown. These results are in agreement with findings by Ashfaq et al. (2008) who report that the more access to additional land that a farmer has the more he or she will be able to engage in crop diversification. The result indicates that by increasing the land holding sizes of a farmer by 1 ha, number of crops grown can increase by 3. However it is difficult to increase landholding sizes of farmers in Malawi

especially due to the growing population resulting in high population density. In this case crop diversification can be achieved by increasing the frequency of producing crops on the same land, e.g. by producing two to three times a year through irrigation and also by practicing mixed cropping (interplanting two or more crops in the same field).

Educational Level of the Household Head

The results indicate a positive and significant relationship between age of household head and crop diversification. This result is just as was expected that as years of education for household head increase, number of crops grown also increase thereby highlighting the importance of knowledge and ability to absorb new information through extension services or other sources. This is because as the number of years of education of the household's head his experience and skills also increases. Thus, it is expected that a high level of education will result into a more commercially oriented agriculture as compared to subsistence agriculture. In addition farmers who have more years of education are more knowledgeable of the importance of diversification. This also shows that farmers with more years of education have the ability to understand new information that is passed to them through extension services and other sources of agricultural information related to weather and are more willing to try out new innovative ways of growing a variety of crops

Household Size

This variable is positively related with number of crops grown and is significant at the 1 percent test level. This outcome is as expected because as the number of adult members of the household increases, there is an increased labor force available to grow a variety of crops.

Number of Children Less Than 12 Years Old

The results indicate a negative significant relationship between crop diversification and number of children aged 12 and below. This is also as expected because a household with more children below 12 years have inadequate labor required to grow more crops because at that age the children contribute very little or no human labor for the household farm. The result may also seem to indicate that since this age range is for school going children, the elder members of the household may be looking for other instant paying off-farm employment in order to pay for the children's school costs thereby reducing the time they work in their gardens and reducing number of crops grown

Government Policies (Access to Loan and Fertilizer Subsidy)

The results indicate a negative and significant relationship between crop diversification and access to fertilizer subsidy. The negative relationship may indicate that fertilizer subsidy encourages specialization especially maize and tobacco production just because only fertilizer required for the production of these two crops is subsidized.

On the other hand access to loan had a positive and significant relationship with diversification. It is imperative that farmers who have accessed input loan are more able to increase the number of crops to grow than those who don't have access to loan. This is because sometimes farmers are unable to plant a particular crop just because they do not have necessary inputs especially seed and fertilizer so with the loan they are able to plant that crop. One example was given during one of the focus group discussions that more farmers planted dry beans in Kasungu district especially because the farmers were provided with bean seed on loan by a Non-Governmental Organization working in the district

Distance to Market

This variable indicates a negative significant relationship with crop diversification even at 1 percent level. This result is as expected because as the distance to the market increases, the tougher and costly it becomes for farmers to take agricultural produce to the market and thereby reducing number of crops grown. This agrees with what was reported by Omamo, 1998; that households with poor access to market face higher transaction cost in buying from or selling to the national economy.

Availability of Electricity

Availability of electricity has a negative and significant relationship with crop diversification. This outcome is as expected because households with electricity are expected to have more diverse income sources and participate less in on-farm activities.

District Effect

This dummy variable has a positive relationship with crop diversification which shows that farmers who are based in Kasungu have a higher probability to diversify than farm households from Machinga district. This may be explained by the differences in the demographic and socio-economic characteristics of the two districts. One example is that Machinga district is densely populated than Kasungu resulting into Kasungu having a higher average land holding size per farmer as compared to Machinga. Therefore as was discussed earlier an increase in land holding sizes results in an increase in number of crops, this may explain why Kasungu has a slightly higher crop diversification index than Machinga

Relative Profitability of Other Crops

The relative profitability (per hectare) of crops was computed as the gross margin of each of the 12 mostly common crops that were identified in the study. In addition to the ten other crops, gross margins for maize and tobacco were also calculated so that they are compared with those of the other crops. This was done by subtracting the value of variable costs from the value of the total production (gross income). Gross margin analyses were conducted on cassava, ground nuts, soybeans, tomato, tobacco, maize, leafy vegetables, pigeon peas, dry beans, Irish potato cowpeas and sweet potato. The analysis was conducted using 2014 prices and production statistics.

The gross income or the value of production was calculated by multiplying the total crop yield by its price. This gross income was calculated using farm gate prices. Variable costs for this study included the monetary values of all inputs including seed, fertilizer, and manure, purchased chemicals, and labor (hired and family). Table 13 depicts gross margins (in Malawi kwacha per hectare) for the 12 crops that were selected.

Table 13: Gross Margins of Different Crops Grown under Smallholder

Crop	Gross Margin (MK/ha)	Gross Margin (US$/ha)
Tobacco	361,065	802.37
Tomato	331,234	736.08
Leafy vegetables	287,371	638.60
Hybrid Maize	232,916	517.59
Soybeans	220,972	491.05
Irish Potato	181,782	403.96
Beans	156,658	348.13
Groundnuts	128,004	284.45
Sweet potato	115,935	257.63
Cassava	112,316	249.59
Pigeon peas	89,339	198.53
Cowpeas	64,435	143.19

Of the crops cultivated, tobacco has the highest average gross margin of about MWK361,065 per hectare as indicated in Table 13. This result indicates that tobacco continues to have a far much more comparative advantage over other crops and this may explain why the crop is still been grown by majority of farmers regardless of its negative effects and publicity. However a study by Mataya and Tsonga (2001) reported that adequate financial returns cannot be realized from high value crops such as tobacco, unless there is increased access to capital, labor and land. This may then indicate that even though the crop has a high gross margin still smallholder farmers are unable to realize much gain from the crop especially because they lack those resources. Majority of the smallholder farmers have small land holdings sizes (average of 0.1 ha) which is inadequate for the production of both cash and food crops under the present level of technology and management hence farmers cannot produce enough tobacco in order to realize a substantial amount of money. In addition to this, tobacco production requires high labor and input intensity as compared to the other crops thereby making the other crops viable options for diversification.

Tomato and leafy vegetables have the second and third highest gross margins respectively. Their gross margins are MK331,234 and MK287,371 respectively. Irish Potato also has quite a high gross margin of MK181,782. These results imply that production of horticultural crops is a relatively profitable alternative to tobacco as compared to other crops. In addition to the high gross margins, the horticulture crops have an added advantage over tobacco in that they can be grown for more than three to four times a year thereby giving the farmer continuous flow of income unlike with

tobacco whereby farmers access income only once when they sell their produce. The other thing is that, these products are in demand throughout the year especially in domestic markets unlike tobacco which has a specific time period for sales which lasts between five to six weeks. These results are further supported by the findings from a study conducted by ARET which was cited in Luso Consult (1995) which shows that cultivation of horticultural crops is a potential alternative source of income to tobacco production. The study used gross margin as an index of profitability, and reported that under good management and with no marketing constraints, growing of horticultural crops, especially leafy vegetables, tomato, Irish potato and bananas, would still be profitable even after prices have dropped by 50 per cent in case of tomatoes and 75 per cent for all other crops. However the major problem with horticultural products as compared to other possible alternatives is that they are highly perishable and sometimes farmers face marketing problems due to high supply versus demand during some peak production periods resulting into lower prices or worse still product loss.

Hybrid maize has a gross margin of MK232,916 which is higher than grain legumes and tubers. This may be attributed to the recent increase in the price of maize relative to the cost of production which has increased its domestic competitiveness among smallholder farmers. Only gross margin for hybrid maize was calculated and not for local maize because the Ministry of Agriculture is promoting the use of improved maize varieties over local varieties among smallholder farmers especially because of its high yielding potential. Hybrid maize has a potential yield of more than 10,000 kg per hectare under good management while local and Open Pollinated Varieties (OPVs) has

potential yield of up to 5000 kg per hectare. (Ministry of Agriculture and Food Security, 2012) Although maize has a higher gross margin than other competing crops, it is difficult to promote it as an alternative cash crop to tobacco especially because it remains the country's major staple food therefore the need for domestic consumption outweighs its importance as a source of income. In addition there are times that due to unforeseen circumstances, domestic maize production does not satisfy demand rendering the government with no choice but to import extra maize in order to meet the production gap and thereby making a huge drain on the country's foreign reserves. In this case promotion of production of more maize among smallholder farmers could be encouraged not as a cash crop but as one of the import substitution crops. This is because farmers who produce surplus maize are encouraged to sell their produce to Agricultural Development and Marketing Cooperation (ADMARC). ADMARC is a marketing body specifically established by government inorder to buy produce from farmers. This maize is later sold to poor farmers at a lower price than what is offered by private traders.

For the grain legumes, soybean has a higher gross margin (MK220,972) followed by dry beans and ground nuts which has gross margins of MK156,658 and MK128,004 respectively. Interestingly pigeon peas and cowpeas have the lowest gross margins among all the 12 crops. These have gross margins of MK89,339 and MK64,435 respectively. The low profitability of pigeon peas and cowpea could be attributed to low productivity, resulting from low use of improved technology. The other reason could be because majority of farmers do not plant these crops in pure stands, usually the crops are inter-planted with other crops resulting into low productivity because of shading and

other factors. The other issue with pigeon pea is in its unpopularity in some districts of the country (it was earlier reported that no farmer planted pigeon pea in Kasungu in 2008/2009 cropping season). In order to improve the gross margins from pigeon pea and cowpea, it is good to encourage farmers to adopt improved varieties which are high yielding than local varieties. On the other hand, soybean production faces the problem of price invariability. Since soya was introduced in the country, ADMARC which is the government's marketing body has been the major buyer of the crop. In the initial stages, the prices were very high because a few of farmers grew the crop. This led to high supply of the crop on the market because many farmers adopted the crop. Currently majority of those farmers have withdrawn from producing soya because the price is no longer remunerative.

The roots and tubers have relatively low gross margins than the competing crops. These crops have gross margins of MK115, 935.00 and MK112, 316.00 respectively. The low gross margins of these crops could be due to low production levels. Majority of farmers do not grow cassava and sweet potatoes with a business mind as a result they do not invest much into management and production of the crops. The other problem is that these crops are bulky and highly perishable thereby resulting into low income generation. On the other hand these crops have a comparative advantage over the other crops with high margins in terms of their ability to withstand adverse weather conditions especially drought. A study by Mataya and Tsonga (2001) agrees with these findings. In their paper they reported that although root crops have a poor export market potential, their prospects for household income generation in local markets are quite high, especially when food

security and recurring droughts are taken into consideration. Therefore these crops could be promoted among smallholder farmers as alternative staple food. There is also a need to train the farmers in value addition especially food processing and preservation in order to enable the harvested crop to last longer without deteriorating.

CHAPTER 4: CASE STUDIES

In order to learn more of the existing patterns on diversification among small scale farmers, key informant interviews were conducted with farm households who have successfully diversified their crop production. These farm households were strategically selected with the guidance of a village chief from the villages the key informants were based. I was motivated to choose these farmers as key informants because they represent a group of few farmers who have been courageous enough to drop tobacco and invest their time and resources on other cash crops and they have emerged successful. This is because all along farmers believed that for one to be successful he has to grow tobacco and indeed majority of successful and rich farmers in Malawi have achieved their status because of tobacco production. In addition most farmers are afraid to try out new crops, so I feel these farmers have set a good example by trying out new crops like macadamia and fruit trees which are not commonly grown in the study area. Therefore these interviews were conducted with the aim of drawing lessons from these farmers so that other farmers would be motivated to change their mindset and know that it is possible for one to be successful by growing other crops other than tobacco.

Case study 1: Mrs. Jennifer N.

Mrs. N. comes from Kalinga village in the area of Traditional Authority Msakambewa in Kasungu district. She is married to Mr. Alfred N. who is the head of the family. However, the farmer indicated that even though she is not the household head, she is involved in making important decisions concerning their farming activities. Mrs. N.'s household size is 6 with the youngest child aged 11 and the rest of them aged between 18 years and 28 years. Four of the children are still in school while the rest are independent of their parents. A detail of the demographic background of the family is contained in Table 14.

Table 14: Demographic Characteristics of Mr. and Mrs. N's Household

Variable	Number
Age of household head (Years)	48
Age of spouse/respondent (years)	40
Total farm size (acres)	13.2
Household size	6
Number of children < 12 years	1
Average household income (Real cash in MK)	1,019,352
Distance to nearest market Centre (km)	5
Educational level of household head	Primary school drop-out

What Determines the Type of Crop to Grow?

Mrs. N indicated that the issues that influence her decision on the type of crop to grow are the desire to produce more food and market prices of commodities in the previous season. This means that the farm household may consider growing crop which fetched higher prices during last season and drops out those crops that fetched low prices. The crops that the farm household normally grows are maize, ground nuts, tomato, fruit trees, Irish potatoes, cassava and sugarcane, dry beans, pumpkins and green vegetables specifically cabbage, lettuce and okra. These crops are sold as source of income apart from dry beans, pumpkins and green vegetables which are produced solely for food.

Cropland Allocation

Table 15: Cropland Allocation among Crops

Crop	Cropland Allocated (ha)
Fruit trees	2.7
Maize	5.4
Irish potatoes	1
Tomatoes	1.4
Cassava	0.5
Ground nuts	1.2
Sugarcane	0.8
Green vegetables (Lettuce, cabbage, okra)	0.2
Total farm size	13.2

The family has a total landholding size of 13.2 hectares which is under customary land tenure system. According to farmland allocation to crops, maize occupies a larger proportion of the farmland (41%) followed by fruit trees (20%). The family grows other crops which are not allocated special land however they are just inter-planted with other crops more especially maize and ground nuts. These crops are dry beans, pumpkins and cowpeas. In terms of fruit trees, apples occupies a larger share of cropland compared to the other fruits as indicated by Figure 4 below

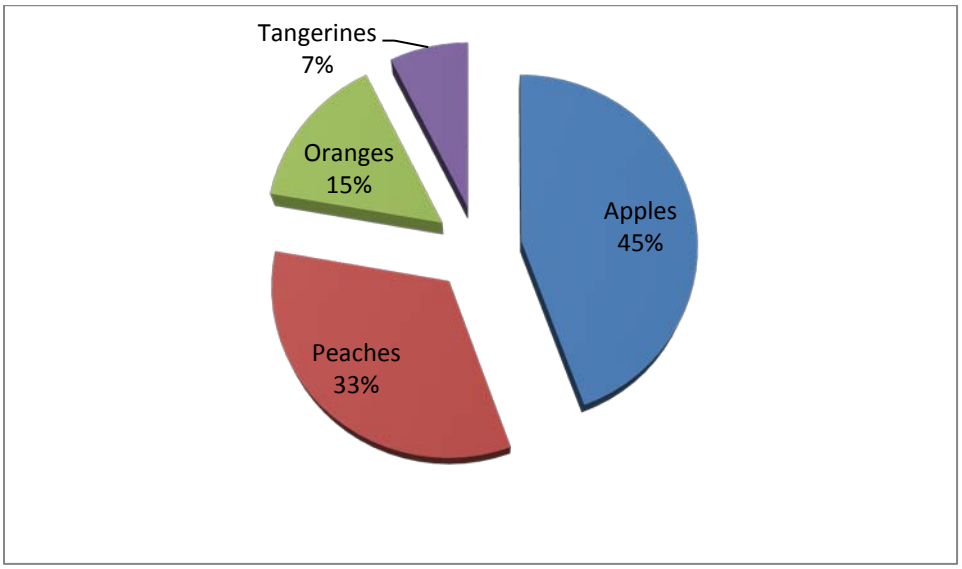

Figure 4: Percentage Share of Cropland among Fruit Trees

Marketing of the Crop Produce

The main buyers of the household produce are vendors and supermarkets. The major difference between the two buyers is that vendors come to buy the produce at

farm-gate while the farmer has to transport the produce to the supermarkets. The supermarkets also buy selected products only especially apples and peaches. However the household do not have a contract with bigger supermarkets that are able to buy his fruits in large quantities as a result he end up selling his fruits to smaller supermarkets that are unable to finish his supply. This is the case because the major supermarkets prefer selling imported fruits especially from South Africa.

Table 16: Comparison between Vendors and Supermarkets

Buyer	Advantages	Disadvantages
Vendors	Proximity	Lower prices
Supermarkets	Higher profits	Higher transport cost
		Purchase only fruits (apples and peaches)

The distance from the farm to the nearest market center is almost 5 km. This is quite a challenge to the farmers especially because the road network is not good. The main road is very far from the farm as a result the household transport their products using a dusty road which makes it difficult to travel, especially during the rainy season.

Crop Diversification

The household reported that that their cropping pattern has changed greatly during the last five years. At first the household was entirely depending on tobacco as the main cash crop but for the past five years they have incorporated other crops especially fruit trees. Initially the farmers started with only tangerines and oranges but by now they have expanded their fruit tree base and concentrates on peaches and oranges so that, as of the time of writing, they no longer grow tobacco.

The household reported that they have been practicing crop diversification for over 5 years now. On reasons why they have completely stopped growing tobacco, the household indicated that they were mainly discouraged because of price fluctuations and the anti-smoking campaigns. There are several organizations which are currently campaigning against tobacco smoking especially because tobacco is a health hazard. This led to the decision by the household to concentrate on growing food crops thereby withdrawing completely from producing tobacco.

Current Economic Status

The household reported that as a household they are better off right now as compared to when they were only depending on tobacco. This is because before they were struggling to pay fees for their children even in cheaper schools but currently they are able to send their children to expensive and reputable schools. In addition to crop production, the household engages in small-scale business and rearing of livestock

especially goats and chickens. The livestock is kept only as a source of manure and for food. They do not sell any of their livestock. The total household income for last season was MK1,089,912. For the year 2013, the household had two sources of income which were crop sales and small-scale business however the major source was crop sales. The total income received from the small-scale business was MK70,560 while the total income from crop sales was MK1,019,352. Details of crop sales are provided in Table 17 below.

Table 17: Income Received from Selling Crops in 2013

Crop	Income (MK)
Maize	324,350
Fruits	377,323
Ground nuts	91,870
Cassava	23,409
Sugarcane	14,400
Tomato	108,000
Irish Potato	80,000
Total Crop Income	1,019,352

Case Study 2: Mr. Henry K.

Mr. Henry K is a retired civil servant. He hails from Kambwiri village, Traditional Authority, Kaluluma in Kasungu district. He is the head of a family of 11 members, which includes him, his wife 4 children and 5 grandchildren. Mr. K is 63 years old and he has been practicing farming for more than twenty years now. He is one of the few farmers who has successfully diversified out of tobacco. Table 18 indicates the demographic characteristics of Mr. Henry K's household.

Table 18: Demographic Characteristics of Mr. K's Household

Variable	Number
Age of household head (Years)	63
Total farm size (acres)	6
Household size	11
Number of children < 12 years	0
Total household income (Real cash in MK)	1,738,000
Distance to nearest market Centre (km)	3.2
Educational level of household head	College graduate

From the Civil Service to the Farm

Mr. K retired from the Civil Service in 1998 and went straight into farming. He was growing tobacco and maize exclusively each and every year for over 12 years just like any other smallholder farmer of that time. The maize was grown as source of food while tobacco was grown as source of income. It was not a rosy journey for him especially with the continued falling of market prices but despite this, Mr. K never thought of diversifying especially because he trusted tobacco to be the only high value crop.

Why Did He Start Crop Diversification?

In 2001, his crop was severely attacked by a strange disease which eventually affected its quality thereby catching very low prices at the market. The sales were very bad that he even failed to support his children in school. This was the first time that he thought about diversification. That year was the first that he planted soya beans and cassava in addition to maize and tobacco. However he could not realize much from the new crops that at some point he thought of dropping them and concentrate on tobacco. Luckily before he dropped the crops, he came across an extension worker from one Non-Governmental Organization who was promoting production of soya and cassava using modern farming technologies. He joined a farmer club that was comprised of farmers who were practicing the new farming techniques and the extension agent was teaching them through demonstrations. In addition to cassava and soybean he also started to produce macadamia nuts and groundnuts. However of all the crops, maize occupies a large proportion of the total farmland especially because he grows the crop for both food

and income. A detail of farmland allocated to different crops is contained in Table 19 below.

Table 19: Cropland Allocation among Crops for Mr. K

Crop	Area (ha)
Maize	3.5
Macadamia nuts	1
Cassava	1
Soybean	1.5
Groundnuts	1
Total farm size	8

With the guidance of the extension worker, the farmer uses new farming technologies on his farm in order to produce more crops. Some of these technologies are use of improved seed and application of inoculant in terms of soybean. As of now he has even stopped growing tobacco because as compared to these two crops, tobacco has many disadvantages. Some of these disadvantages are labor intensiveness, environmental degradation especially because he was planting flue-cured tobacco and the anti-smoking campaigns also discouraged him.

Household Income Sources

The household has three sources of income. In addition to crop sales, the household operates a small-scale business and also as a retired Civil Servant, the farmers receives pension fund. Of the three, crop sales contributes a larger share to the total household income while for the total crop income maize contributes a larger share followed by soybean and macadamia nuts. Tables 20 and 21 below indicate household income sources and actual income received from each source.

Table 20: Household Income Sources

Income Source	Amount (MK)
Crop sales	1,318,000
Pension fund	240,000
Small-scale Business	180,000
Total Household Income	1,738,000

Table 21: Total Crop Income

Crop	Income (MK)
Maize	650,000.00
Macadamia	310,000.00
Cassava	90,000.00
Soybean	268,000.00
Total crop income	1,318,000.00

Marketing of the Crop Produce

The major buyers of the farmers' produce are vendors, ADMARC and boarding school (especially for maize). The farmer reported that he is able to receive higher prices with macadamia nuts because the government regulates the minimum prices for the buyers and he supplies all his surplus maize to a boarding school where he has a contract with. The only challenge he faces is the fluctuation of soybean market The only problem he finds with soya is that there is high uncertainty with the prices as they fluctuate a lot by each year but with cassava there is high market prospects and high demand because bread makers now use cassava flour to make their bread and also people use it as alternative to maize (food).

Constraints to Diversification

From the discussion I conducted with the five farmers selected as key informants, it was established that the reason why most farmers do not diversify their crop production but continue relying entirely on tobacco production is because tobacco is the most reliable crop to most farmers. This is because the government has invested a lot in the marketing structures of tobacco so everyone is assured of selling their produce which is not the case with the other crops. The other reason is that most of the farmers lack information on how other crops can be grown as such they just grow tobacco. In addition tobacco farmers face lesser transport problems because the buyers organize transport for the tobacco produce right from the farm. In order to promote diversification, the farmers suggested that the government should establish ready markets for the other crops as well so that more farmers start diversification. They also suggested that government extension workers should intensively train farmers on benefits of diversification and on the agronomic practices of growing other high value crops.

Which Crops should be Promoted?

From the five farmers' experiences and opinion, they indicated that the following crops are profitable and therefore should be promoted as good alternatives to tobacco. The crops are green maize, soybean, fruit trees, tomato, Irish potato, ground nuts and macadamia. The advantages of these crops over tobacco are that they require less labor and investment. For example, once you plant a fruit or nut tree it will produce for a long

period of time. And in addition they are food items as compared to tobacco, which is a health hazard.

Table 22: Challenges Faced by the Farmers and Suggested Solutions

Challenge	Solution
Higher transportation costs	Bought a van for transporting the produce
Poor road infrastructure	Government to assist
Lower prices	The farmers to form cooperatives so that they sell their produce in bulk
Lack of good markets	Government should focus on promoting and investing in other crops as well rather than just tobacco
	Extension workers to teach the farmers on the innovative ways of growing the alternative crops
	Government should restrict imports of food commodities in order to boost the local farmers industry

Case Studies Summary

From the two case studies discussed above, it has been found that factors that encourage crop diversification are larger farm sizes since both farmers had larger farm sizes as compared to average smallholder farmer, higher educational level as was the case

with Mr. K. These results further support the findings presented earlier on from the regression analysis. It was also reported that price of the commodity for the previous season, the necessity for food and high demand influences their decision on which crops to grow.

The major challenges faced by the farmers are higher transportation costs, poor road infrastructure, lower prices and lack of good markets. Just through the experiences of these farmers, green maize, ground nuts, soybean, macadamia nuts and fruits are some of the crops that could be good alternatives to tobacco. From this analysis I therefore conclude that the government should aim at promoting these crops among smallholder farmers because they are food items, require less labor and cost to produce as compared to tobacco.

CHAPTER 4: CONCLUNSION AND POLICY RECOMMENDATIONS

Conclusion

This thesis was conducted with the specific objectives of studying the existing patterns of crop and income diversification, to identify the major determinants that influence farmer's decisions to diversify and to assess the profitability of different important cash crops that are commonly grown among smallholder farmers.

Simpsons Index of diversification, Gross margin analysis, OLS and Tobit regression techniques were employed to analyze the data for the study. Simpsons Index of diversification was used to measure the extent of diversification for both crop and income sources. The study has shown that high diversification levels exist among the farm households from the study areas in terms of number of crops grown and number of income sources. Crop diversification may help the smallholder farmers to meet their consumption needs, reduce risk associated with weather or disease outbreak and for economy of scale.

Gross margin analysis was used as criterion for identifying alternative commodities to tobacco. The results indicate that despite the decreasing prices, tobacco continues to have high comparative advantage over other crops in terms of its commercial value. This could be attributed to the high investment that the government has made to the tobacco sector as compared to the other crops. Tobacco has a readily

available and well guaranteed market in that everything that the farmers produce is sold which is not the case with the other crops. The profitability of maize is higher under the assumption that it is reserved for consumption. Horticulture crops (tomato, leafy vegetables and Irish potato), Soybean, dry beans and groundnuts are possible alternatives to tobacco as they have high gross margins and comparative advantages in terms of number of times they can be grown per year over tobacco. The crops also require less labor and inputs as compared to tobacco and in addition they are safe and healthy for human and environment as compared to tobacco. The study also revealed that most of these crops do not have reliable markets for domestically and internationally as it is the case with tobacco which leads to poor adoption by farmers. The study further revealed that some of these crops, especially horticultural crops, are bulky and highly perishable which requires their value addition through improved methods of processing and storage. Thus, there is a need to train the farmers on the necessary technology required for the crops' value addition. These technologies include high yielding varieties, improved husbandry practices, handling, grading and packaging.

OLS and Tobit regression models were used to analyze the determinants of crop diversification. The results indicated that the socioeconomic characteristics of the households such as age and level of education of the household head, number of children under 12 years old, household size, land holding size, access to input loan, distance to market and ownership of livestock units significantly determine the level of crop diversification. Age of household head, distance to market, availability of electricity and number of children less than 12 years old showed a negative relationship with crop

diversification while educational level, household size, land holding size, livestock ownership and access to loan were found to favor crop diversification. Comparing the two districts, the results indicate that there are significant differences in crop diversification levels between the two districts. Machinga district is associated with less crop diversification than Kasungu district. The lower level of crop diversification in Machinga district could be explained by the fact that majority of farmers have lower farm sizes in Machinga than in Kasungu. In terms of gender, I find that there is no statistically significant difference between female-headed households and male-headed households with respect to both crop and income diversification. However female-headed households have lower levels of crop diversification, on average, than do male-headed households.

Policy Recommendation

The study suggests a number of recommendations for promoting crop diversification beyond tobacco among smallholder farmers. Firstly there is need for the government to consider undertaking policies that will improve farmers' access to and control over land in areas where there is idle land and to intensify promotion of irrigation in areas where the farmers face small landholding sizes so that farmers are able to grow crops twice or thrice per year on the same land. This is because the study has found that improved access to more land will enable farmers to grow more crops. The government should also consider formulating policies that are aimed at construction of infrastructure like road networks and markets among the rural farm households. This is because the

study revealed that farmers are more willing to diversify if they are close to market centers and if they have good road networks.

Overall, from this study, if the government wants to commit resources to support development of 10 commodities from production, processing, to marketing among the study population, I would recommend soybean, tomato, leafy vegetables, ground nuts, Irish potato, cassava, macadamia nuts, dry beans, sweet potato and fruits.

Areas for Future Research

The quantitative results in this study should only be regarded as suggestive and not conclusive because of several factors. First, the econometric estimation of the models does not control for crop prices therefore it is expected that there might be significant changes in the study outcomes if there are any big changes in market prices. The other thing is that the profitability of the enterprises was analyzed using the gross margins which are a crude measure of profitability. Gross margins fail to capture competitiveness to resource use between one enterprise and another. In addition, gross margins ignore the contribution of fixed capital and depreciation to profitability of competing enterprises and thus they overestimate the degree of competitiveness. Therefore apart from gross margin analysis, future research should consider incorporating additional economic indicators. Further research should also consider expanding the dataset to cover several districts in the south, central and northern regions so that the geographic suitability of some crops is taken into account. And finally, subsequent similar studies are encouraged to include crop prices.

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APPENDICES

Appendix A: Attendance during Focus Group Discussions

Village	Traditional Authority	District	Attendance		
			Male	Female	Total
Mayilosi	Chakhaza	Dowa	13	5	18
Kalele	Njombwa	Kasungu	7	13	20
Ng'ona	Njombwa	Kasungu	12	16	28
Kabanda	Chakhaza	Dowa	9	7	16
Chasowa	Chakhaza	Dowa	9	12	21
Total			50	53	103

Appendix B: Interview Guide for Farmer Focus Group Discussions

District: _____

EPA: _____

Village: _____

Current population: _____

Number of households: _____

1. What are the issues that influences your decision of the type of crop to grow

   Kodi ndi zinthu ziti zomwe zimakutsogolerani pakasankhidwe ka mbewu yoti mulime?

2. What are the important cash crops grown in this village starting with the mostly grown?

   Tchulani mbewu zimene mumalima kuti muzigulitsa kuyambira yomwe imalimidwa kwambiri

3. What was the price per kg of these crops past selling season?

   Mitengo inali bwanji pa kg ya mbewu zimenezi?

   Cassava: *Vegetables:* *Ground nuts:* *Cotton :*

   Sweet potatoes: *Irish Potatoes:* *Beans:*

4. How many households grow more than one crop in this village?

   Ndi mabanja angati mmudzi muno analima mbewu zogulitsa ziwiri kapena kuposera apo?

5. What are the advantages of growing more than one crop per household

   Ndi ubwino wanji umene ulipo alimi akamalima mbewu ziwiri kapena kuposera apo

6. What are the major challenges that limit farmers to grow other crops in addition to maize and tobacco?

   Ndi mavuto ati amene amalepheretsa alimi kulima mbewu zina poonjezera pa fodya ndi chimanga?

7. What could be done to deal with those challenges? Farmers efforts and governments'

   Mukuona ngati mavuto amenewa angathe bwanji?

   Nanga mukuona ngati bola lingachitepo chani pothana ndi mavuto amenewa?

8. What % of farm households in this village grew tobacco during 2012/13 season?

   Ndi mabanja angati mmudzi muno analima fodya chaka chatha

9. Why do most farmers continue to grow tobacco other than other crops

   Ndi chifukwa chani alimi ambiri amalimbikirabe kulima fodya pamene palinso mbewu zina zopindulitsa?

10. Who are the main buyers of agriculture produce in this area?

    Kodi mbewu zimenezi amakugulani ndi ndani?

11. What is the distance to the nearest ADMARC market?

    Pali mtunda wautali bwanji kukafika ku ADMARC yomwe muli nayo pafupi?

12. What are the 3-4 main problems that farmers face in selling other crops rather than maize and tobacco in this area? (list)

    Ndi mavuo anayi ati amene alimi amakumana nawo akamagulitsa mbewu zinazi amene sapezeka akamagulitsa chimanga kapena fodya?

13. What are other sources of off-farm income in this village

    Kupatula ulimi anthu ammudzi muno amapeza ndalama kuchokera ku chani?

14. Compared to 10 years ago, is the overall marketing conditions for small farmers selling tobacco better, the same, or worse now? 1= yes 2=no 3=same

    Mu zaka 10 zapitazi, kagulitsidwe ka fodya kakukwera, kakupita pansi or ndi chimodzimodzi?

15. Are farmers in this area shifting their land and labor over time from maize and tobacco to other crops / farming activities? If so, which ones: _____

    Kodi alipo anthu mmudera lino amene akusiyiratu kulima fodya, nkumalima mbewu zina pamalo pomwe amalima fodyapo?

Appendix C: Interview Guide for Key Informants Interviews

Name of farmer:	
Village:	
Traditional Authority:	
Age:	
Household size:	
Sex	
Type of household. *Wankulu wapabanja*	

1. What are the issues that influences your decision of the type of crop to grow

   Kodi ndi zinthu ziti zomwe zimakutsogolerani pakasankhidwe ka mbewu yoti mulime?

2. What crops do you grow?

   Kodi mumalima mbewu zanji?

3. What cash crops do you grow?

   Ndi mbewu ziti zimene mumalima kuti muzigulitsa?

4. Where do you sell your produce?

   Mbewu zimenezi mumagulitsa kuti?

5. What is the distance to the nearest market centre?

   Ndi mtunda wautali bwanji kuti mukafike ku msika omwe muli nawo pafupi?

6. How has your cropping pattern changed as compared to 5 years ago

Kodi ulimi wanu wasintha bwanji mu zaka 5 zapitazi?

7. For how long have you been practicing crop diversification?

   Kodi mwakhala mukupanga ulimi wakasakaniza kwa zaka zingati? Makamaka mbewu zogulitsa

8. What made you diversify out of tobacco?

   Chinakuchititsani ndi chani kuti muyambe kulima mbewu zina zogulitsa pophatikiza pa fodya

9. Are you worse-off or better off now compared to when you were not diversifying your cash crop base?

   Moyo wanu mukuwuona bwanji panopa kuyerekeza ndi mmene munkangodalira fodya yekha ngati mbewu yokupezetsani ndalama?

10. Why do you think most people do not diversify out of tobacco?

    Kodi ndi chifukwa chani anthu ambiri akumakakamirabe kulima fodya mmalo mwa mbewu zina zomwe zimabweretsa ndalama?

11. In your opinon what are the most profitable crops as compared to tobacco?

    Mmaganizo anu ndi mbewu zina ziti zomwe ziliso zopindulitsa chimodzimodzi ngati fodya?

12. What advantages these crops have as compared to tobacco?

    Ndi ubwino wanji umene mbewu zimenezi uli nazo poyerekeza ndi fodya?

13. What challenges have you met/do you meet during your transition into diversification

Ndi mavuto anji amene mwakumana/mukukumana nawo pamene mukulima mbewu zina zogulitsa poonjezera fodya?

14. How have you dealt with these challenges?

Mavuto amenewa mmathana nawo bwanji?

15. How do you think the government can come in to tackle these challenges

Kodi mukuona ngati boma lingachitepo chani pothana ndi mavuto amenewa?